UV Raman Spectroscopy for Explosives Detection

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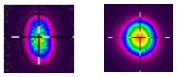
➢ Objective:

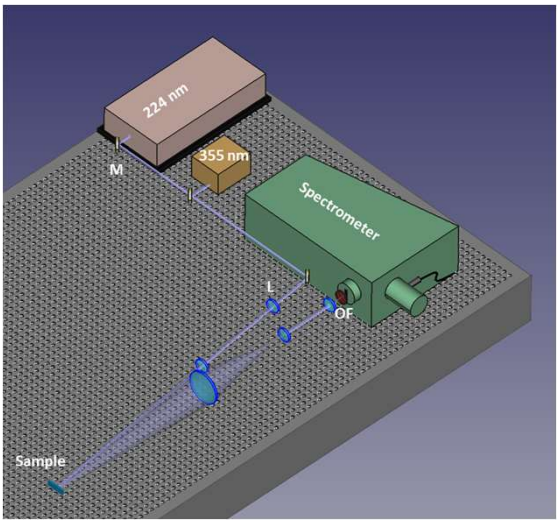
- Identification of explosive traces at a safe distance using UV Raman spectroscopy
  - Determination of the detection limits for samples on glass substrates. µg amounts resemble a chemical trace left by a fingerprint

➢ Lab setup:

- Portable 355 nm, 224 nm lasers
- Collecting optics: UV lens ~ 60 cm in front of the sample - spectrometer (liquid N_2 cooled CCD, grating 2400 grooves/mm, laser line filter)
- Photo degradation minimized (laser energy < 10 mW/cm^2)

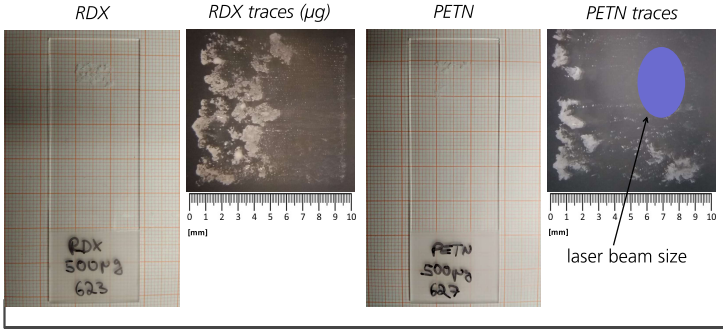
UV Laser beam features:
1 mW, 3 s minimum acquisition time



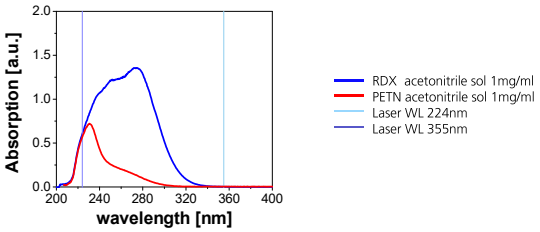


➢ Sample preparation:

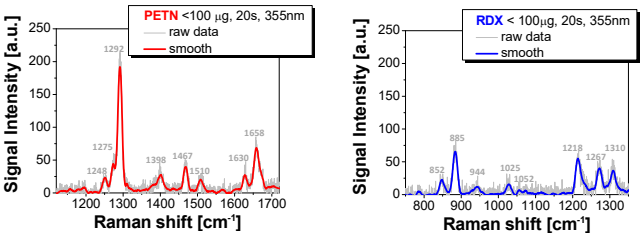
- Standardized samples of milligrams and traces (µg range) were ink-jet printed on a glass substrate
- Samples simulate possible explosive trace amount adhering on a surface



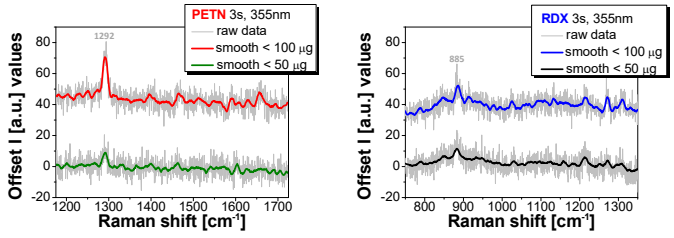
➢ Results:



- PETN (red) and RDX (blue), samples < 100 µg, 20 s, 355 nm:



- Minimized acquisition time 3 s, 355 nm, < 100 µg and < 50 µg:



➢ Findings:

- A UV Raman setup for measuring explosive traces was successfully tested
- Lowest detection limit was < 50 µg for 0.6 m distance for 3 s, at 355 nm
- No distinguishable signal for laser at 224 nm: too close to absorption peaks
- Tested compounds successfully identified

➢ Future developments:

- Find the optimum excitation wavelength for later applications (i.e. miniaturization)
- Test different surfaces, inhomogeneous contamination, low concentrations
- Eye safe range

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